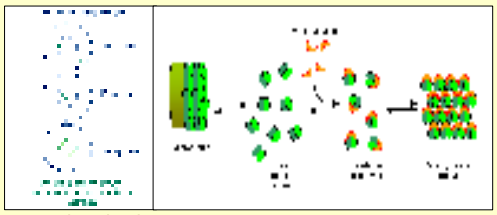
E OF PACLITAXEL, VINBLASTINE AND VINCRISTINE IN MODERN CANCER THERA

Aritrika Sinha[1], Nilufa Nasrin[1], Ranjan Shaw[1] ,Trina Bhattacharya[1] , Upasana Banerjee[1]
and Suranjana Sarkar*[1]
Department of Botany, Surendranath College. 24/2 Mahatma Gandhi Road, Kolkata-700009

Introduction

In generic era of modern biotechnology still natural products represent over 50% of all drugs in clinical use. The World Health Organization estimates that 85% of traditional medicine involves the use of plant extracts and about 80% of the people in developing countries of the world depend on traditional medicine for their primary health care. Among the 87 anticancer drugs approved over the past ten years, 62% are of natural origin. The major drugs include Paclitaxel, Vinblastine and Vincristine extracted from *Taxus brevifolia* and *Catharanthus roseus* respectively. All of them prevent the multiplication of cancer cells by binding to tubulin and blocking the polymerization to form microtubules required for cell division.



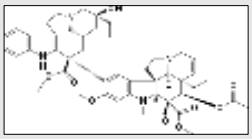
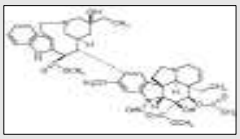
The evidence from epidemiological and experimental studies that highlight the importance of compounds derived from plants "phytochemicals" are medically more important to reduce the risk of cancer and inhibit the development and spread of tumours in experimental animals.

Plant Materials

1. Madagascar periwinkle / Nayantara
Family Apocynaceae
Scientific Name:
Catharanthus roseus (L.) G. Don
Synonym: *Vinca rosea* L.

2. Pacific yew
Family: Taxaceae
Scientific Name:
Taxus brevifolia

Salient Features

	Paclitaxel (Taxol)	Vinblastine (Velban)	Vincristine
Structure			
Chemical Formula:	$C_{47}H_{51}NO_{14}$	$C_{46}H_{58}N_4O_9$	$C_{46}H_{56}N_4O_{10}$
Molecular Weight:	853.9 g/mol (Computed by PubChem, 2019)	811 g/mol (Computed by PubChem, 2019)	825 g/mol (Computed by PubChem, 2019)
Discovery	First isolated in 1971 by Monroe E. Wall and Mansukh C. Wani	First isolated in 1958 by Robert Noble and Charles Thomas Beer	First isolated in 1961 by Gordon Svoboda
Chemical Nature	Tetracyclic diterpenoid, lipophilic in nature	Natural Vinca Alkaloid comprising of two multiringed units: vindoline and catharanthine	Natural Vinca Alkaloid,
Source Plant Part	Bark of pacific yew tree *Taxus brevifolia*	Mainly from leaves and partly from stems and buds of *Catharanthus roseus*	Mainly from leaves and partly from stems and buds of *Catharanthus roseus*
Physical Nature	This anti-neoplastic drug appears as fine white powder.	White to slightly yellow crystalline solid, melting point is 267°C	White crystalline solid , melting point is 218°C
Uses	Ovarian cancer, breast cancer , AIDS related Kaposi's sarcoma and lung cancer.	Hodgkin's disease , lymphoma , breast cancer, testicular cancer.	Hodgkin's lympho sarcoma , Wilm's tumour , Ewing's sarcoma, acute leukaemia, malignant lymphoma, acute erythraemia, and acute panmyelosis
Mode of Action	Paclitaxel interferes with the normal function of microtubule growth by hyper-stabilizing their structure. This destroys the cell's ability to use its cytoskeleton in a flexible manner. Specifically, Paclitaxel binds to the β subunit of tubulin. Tubulin is the "building block" of mictotubules, and locks these building blocks in place. This adversely affects cell function because the shortening and lengthening of microtubules is necessary for their function as a transportation highway for the cell. Further research has indicated that Paclitaxel induces programmed cell death (apoptosis) in cancer cells by binding to an apoptosis stopping protein called Bcl-2 (B-cell leukemia 2) and thus arresting its function.	The antitumor activity of Vinblastine is thought to be due primarily to inhibition of mitosis at metaphase through its interaction with tubulin. Vinblastine binds to the microtubular proteins of the mitotic spindle, leading to crystallization of the microtubule and mitotic arrest or cell death.	The antitumor activity of Vincristine is thought to be due primarily to inhibition of mitosis at metaphase through its interaction with tubulin. Like other vinca alkaloids, Vincristine may also interfere with: 1) amino acid, cyclic AMP, and glutathione metabolism, 2) calmodulin-dependent Ca2+-transport ATPase activity, 3) cellular respiration, and 4) nucleic acid and lipid biosynthesis.

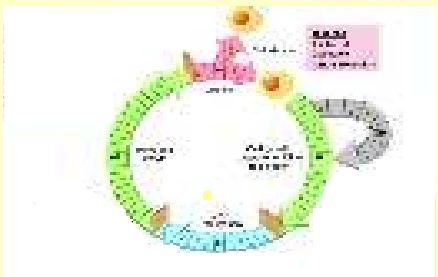


Diagram of the cell cycle indicating the stage in which Taxanes and Vinca alkaloids are most effective for tumour control.
(Source: https://obgynkey.com/chapter-27-principles-of-chemotherapy/)

Conclusion

This review is aimed at conferring the efficacy of anticancer property of three different phytochemicals- Paclitaxel, Vinvcristine and Vinblastine. Cancer is one of public health burden in developed and developing country. These three natural Cancer chemo preventive agents, are capable of preventing or inhibiting the process of carcinogenesis. Paclitaxel, Vinblastine and Vincristine drugs have a strong inhibitory effect on monozygotic leukemia, breast cancer, lung cancer, liver cancer, ovarian cancer, head and neck cancer, testicular cancer, solid sarcoma and malignant melanoma in a variety of spontaneous or transplanted lymphocytic leukemia. The structure of Vinblastine and Vincristine is very similar. There are some differences in their pharmacological effects only and there is no cross-resistance. However, anti-tumourous effects still face challenges and have a long way to go. The process of research and development of these drugs will provide more meaningful future revelations.

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